PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-247675
(43)Date of publication of application : 19.09.1997

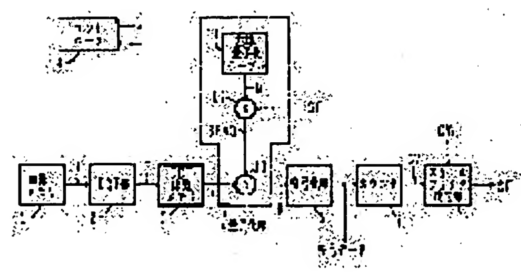
(51)Int.Cl. H04N 7/30
H03M 7/30
H04N 1/41

(21)Application number : 08-056488
(22)Date of filing : 13.03.1996

(71)Applicant : FUJI FILM MICRO DEVICE KK
FUJI PHOTO FILM CO LTD
(72)Inventor : YASHIMA HIDEAKI

(54) IMAGE COMPRESSION METHOD AND IMAGE COMPRESSION SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To generate code data through highly accurate fixed length processing by coding object image data with a compression degree corresponding to an object code volume and using a generated correction characteristic line so as to obtain a correction compression degree.



SOLUTION: The system is provided with an image memory 1, a discrete cosine transformation(DCT) section 2, a DCT coefficient memory 3, a quantization section 4, a coding section 5, a counter 6, a scale factor decision section 7 and a controller 8. Then in order to generate code data of an object code volume, a compression degree corresponding to an object code volume on a 1st characteristic line and a 1st code volume is obtained by coding object image data at the compression degree. Then based on the code volume, a correction characteristic line is generated and a correction compression degree corresponding to the object code volume is obtained on the correction characteristic line. The correction compression degree is estimated as the compression degree to generate code data of the object code volume and object image data are coded by the correction compression degree.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] The 1st coding process of asking for the 1st code volume which encodes object image data with the condensation corresponding to target code volume in the 1st characteristic ray which shows condensation and the relation of code volume, and is obtained by this coding, The characteristic ray correction process which generates a correction characteristic ray based on said 1st code volume, The picture compression approach including the condensation correction process of asking for the correction condensation corresponding to target code volume using said correction characteristic ray, and the 2nd coding process which encodes object image data with said correction condensation, and generates code data.
[Claim 2] Said condensation correction process encodes object image data with two or more condensation in the field which contains the condensation corresponding to target code volume using said correction characteristic ray. The 3rd coding process of asking for two or more code volumes obtained by this coding, respectively, The picture compression approach including the process which generates the 2nd characteristic ray which shows condensation and the relation of code volume based on said two or more code volumes, and the process which asks for the correction condensation corresponding to target code volume in said 2nd characteristic ray according to claim 1.
[Claim 3] Furthermore, said 1st characteristic ray is the picture compression approach according to claim 2 decided according to the class of this chosen object image data including the mode selection process for choosing the class of object image data.
[Claim 4] It is the picture compression approach according to claim 2 or 3 that the said 1st, 2nd, and 3rd coding processes are processes encoded using quantization, and said condensation is decided by the step of quantization.
[Claim 5] It is the picture compression approach according to claim 2 to 4 that said object image data consists of two or more blocks, said 1st and 3rd coding processes encode about the sample block of the object image data, and said 2nd coding process encodes about all blocks of object image data.
[Claim 6] Said characteristic ray correction process is the picture compression approach according to claim 1 which is the process which chooses the correction characteristic ray said 1st characteristic ray is chosen in said 1st coding process as one of two or more representation characteristic rays which show condensation and the relation of code volume, and nearest between said two or more representation characteristic rays based on said 1st code volume.
[Claim 7] Furthermore, said two or more representation characteristic rays are the picture compression approaches according to claim 6 decided according to the class of this chosen object image data including the mode selection process for choosing the class of object image data.
[Claim 8] It is the picture compression approach according to claim 6 or 7 that said object image data consists of two or more blocks, said 1st coding process encodes about the sample block of the object image data, and said 2nd coding process encodes about all blocks of object image data.
[Claim 9] It is the picture compression approach according to claim 6 to 8 that said 1st and 2nd coding processes are processes encoded using quantization, and said condensation is decided by the step of

quantization.

[Claim 10] A storage means to memorize the 1st characteristic ray which shows condensation and the relation of code volume, 1st coding means to ask for the 1st code volume which encodes object image data with the condensation corresponding to target code volume in said 1st characteristic ray, and is obtained by this coding, A characteristic ray correction means to generate a correction characteristic ray based on said 1st code volume, The picture compression system which has a condensation correction means to ask for the correction condensation corresponding to target code volume using said correction characteristic ray, and the 2nd coding means which encodes object image data with said correction condensation, and generates code data.

[Claim 11] Said condensation correction means encodes object image data with two or more condensation in the field which contains the condensation corresponding to target code volume using said correction characteristic ray. 3rd coding means to ask for two or more code volumes obtained by this coding, respectively, A picture compression system including a means to generate the 2nd characteristic ray which shows condensation and the relation of code volume based on said two or more code volumes, and a means to ask for the correction condensation corresponding to target code volume in said 2nd characteristic ray according to claim 10.

[Claim 12] Said characteristic ray correction means is a picture compression system according to claim 10 which chooses the correction characteristic ray said storage means memorizes two or more representation characteristic rays which show the condensation containing said 1st characteristic ray, and the relation of code volume, and nearest between said two or more representation characteristic rays based on said 1st code volume.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the image compression technology which can compress a digital image and can lessen the amount of data about digital image processing.
[0002]
[Description of the Prior Art] Although a picture compression system is used, a digital still camera is in one. A digital still camera photos a digital static image by turning a lens to a photographic subject and pushing a shutter carbon button. The data compression of the image by which image formation is carried out through a lens is changed and carried out to an electrical signal, and it is memorized by the memory card which can be renewed. A data compression reduces the amount of data, and it is performed in order to make a memory card memorize many image data.
[0003] The amount of the code data obtained by carrying out the data compression of the digital image changes with spatial frequency distribution which a digital image has. For example, the amount of code data can seldom be lessened about the digital image containing many high frequency components. On the other hand, about a digital image with few high frequency components, the amount of code data can be lessened considerably. That is, although it changes with methods of a data compression, the amount of the code data generally generated by the data compression changes with classes of digital image.
[0004] The code data by which the data compression was carried out is memorized by storages, such as a memory card. A memory card has the memory capacity of 1 M byte, and cannot make 1 M bytes or more of data memorize in that case.
[0005] In order to make it not write code data in a memory card more than 1 M byte, it is necessary to tell a photography person about the remaining number of sheets recordable for a photography person's facilities. The code data by which a data compression is carried out is not based on the class of digital image, but if it is all the same amount of data per each image, a photography person can be easily told about the number of sheets of a digital image recordable on a memory card.
[0006] However, when the amount of code data is adjustable, a photography person cannot be told about the remaining number of sheets. If there are few amounts of code data of the image to be photoed from now on, many number of sheets is recordable, and if there are many amounts of code data of the image to photo, only small number of sheets is recordable.
[0007] So, in case the data compression of the digital image is carried out, to perform fixed-length-ized processing of code data is desired. By performing fixed-length-ized processing, even if it is what kind of digital image, it is convertible for the code data of about 1 quantum. Fixed-length-ized processing is processing for carrying out the data compression of the digital image of one sheet (one frame), and generating fixed-length code data. If code data is a fixed length, a photography person can be easily told about the remaining number of sheets.
[0008] Next, fixed-length-ized processing is explained. In order to perform fixed-length-ized processing, statistics processing is first performed as pretreatment, the condensation of a data compression is adjusted according to the result of the statistics processing, and fixed-length code data is generated.

[0009] A photography person's push of a shutter carbon button incorporates a digital image. Next, statistics processing is performed to the incorporated digital image. Statistics processing is processing which guesses the code data of the amount of which about is generated, when it compresses about the incorporated digital image.
[0010] Termination of statistics processing performs compression processing and storage processing. as a result of statistics processing, more code data are generated and meet -- what is necessary is just to compress by setting up condensation more highly, if it is surmised that it comes out code data is generated fewer and meets -- what is necessary is just to compress by setting up condensation lowness, if it is surmised that it comes out The code data generated by the data compression serves as the always almost fixed amount of data.
[0011] Then, the code data by which the data compression was carried out is recorded on a memory card by storage processing. Above, a series of processings to the record to a memory card from incorporation of a digital image are ended.
[0012]
[Problem(s) to be Solved by the Invention] There are the following approaches as an approach of performing fixed-length-ized processing of code data. First, compression processing is performed once with the condensation of criteria as statistics processing. Consequently, when more amounts of data than the target amount of data are generated, it is set as condensation higher than the condensation of criteria. On the other hand, when the code data of an amount smaller than the target amount of data is generated, it is set as condensation lower than the condensation of criteria. With the set-up condensation, formal compression processing is performed and the code data of an image is generated.
[0013] However, since the relation between condensation and the amount of code data changes with classes of image, dispersion produces it for the error of the target amount of data and the amount of code data generated. Only by performing statistics processing once, the precision of fixed-length-izing is low.

[0014] The purpose of this invention is offering the picture compression approach highly precise fixed-length-ized processing being performed. Other purposes of this invention are offering the picture compression system which can perform highly precise fixed-length-ized processing.
[0015]
[Means for Solving the Problem] The picture compression approach of this invention encodes object image data with the condensation corresponding to target code volume in the 1st characteristic ray which shows condensation and the relation of code volume. The 1st coding process of asking for the 1st code volume obtained by this coding, The characteristic ray correction process which generates a correction characteristic ray based on said 1st code volume, The condensation correction process of asking for the correction condensation corresponding to target code volume using said correction characteristic ray, and the 2nd coding process which encodes object image data with said correction condensation, and generates code data are included.
[0016] The 1st characteristic ray is decided as what shows condensation and the relation of code volume. In order to generate the code data of target code volume, in the 1st characteristic ray, it asks for the condensation corresponding to target code volume first. Object image data is encoded with the condensation concerned, and it asks for the 1st code volume obtained by the coding concerned. And a correction characteristic ray is generated based on the 1st code volume, and it asks for the correction condensation corresponding to target code volume in the correction characteristic ray concerned. Correction condensation is presumed as condensation for generating the code data of target code volume. By encoding object image data with correction condensation, highly precise code data is generable.
[0017] A storage means to memorize the 1st characteristic ray with which the picture compression system of this invention shows condensation and the relation of code volume, 1st coding means to ask for the 1st code volume which encodes object image data with the condensation corresponding to target code volume in said 1st characteristic ray, and is obtained by this coding, A characteristic ray correction means to generate a correction characteristic ray based on said 1st code volume, It has a condensation

correction means to ask for the correction condensation corresponding to target code volume using said correction characteristic ray, and the 2nd coding means which encodes object image data with said correction condensation, and generates code data.
[0018]
[Embodiment of the Invention] Drawing 1 is the block diagram showing the picture compression structure of a system by the example of this invention. This picture compression system generates the code data based on the JPEG (joint photographic expert group) method which is a standard compression method of a digital static image. The resource of the system of the conventional JPEG method is utilizable as it is.
[0019] A picture compression system has an image memory 1, the discrete cosine transform (henceforth DCT) section 2, the DCT coefficient memory 3, the quantization section 4, the coding section 5, a counter 6, the scale-factor decision section 7, and a controller 8. A controller 8 delivers a timing signal among other the processing blocks of all, and adjusts the timing during a processing block.
[0020] Next, each processing block is explained. Image memories 1 are DRAM and a flash memory, and memorize the image data of one frame. In the image memory 1, image data is usually memorized in the raster format. Image data consists of two or more pixel data.
[0021] Raster formats are the following pixel data lists about the image of one frame. First, it begins from the pixel of the upper left corner of an image, and stands in a line one by one toward a right horizontal direction. If it carries out to a right end pixel, it will begin from the pixel at the left end of next Rhine, and will stand in a line one by one toward a right horizontal direction. Hereafter, it carries out to Rhine under No. 1 similarly. The pixel of a lower right corner serves as the last data.
[0022] Since a picture compression system processes fundamentally in the block unit which consists of 8x8 pixels, an image memory 1 changes image data into a block type from a raster format, and supplies it to the DCT section 2. The number of image data of monochrome image is one. Although a color picture separates to brightness data and color data, the raster / block conversion of each data are carried out as another image data.
[0023] Block types are the following pixel data lists about the image of one frame. Field division of the image of one frame is carried out at two or more blocks. 1 block is 8x8 pixels. Like the above-mentioned raster format, the sequence of the block in one frame begins from the block of an upper left corner, and is located in a line with a right horizontal direction. If a right end is arrived at, it will move to the list of the following block and will rank with the right from the left. Hereafter, the same list is repeated. The last block is a block of a lower right corner. The pixel data list within a block is the same as that of a raster format too, begins from the pixel data of the upper left corner within a block, and is located in a line with a right horizontal direction. If a right end is arrived at, it will move to next Rhine. The last pixel data are pixel data of the lower right corner within a block.
[0024] Image data I of a block type is supplied to the DCT section 2. Hereafter, processing is performed by making 1-block image data into one unit. That is, JPEG compression divides the image of one sheet into a 8x8-pixel block, and carries out the following processings for each block to a unit.
[0025] The DCT section 2 performs DCT processing about image data [of a block unit] I. DCT processing is the transposition cosine coefficient matrix Dt about image data I. The DCT multiplier F is obtained by inserting by the cosine coefficient matrix D and performing matrix operation.
[0026] The F=Dt IDDCT multiplier F is the matrix of 8x8, and shows a spatial-frequency component. The DCT coefficient memories 3 are DRAM and SRAM, and memorize the DCT multiplier F generated in the DCT section 2.
[0027] Next, the configuration of the quantization section 4 is explained. Memory 11 memorizes the basis child-ized table Q. Drawing 2 shows the example of the basis child-ized table Q. As mentioned above, since a picture compression system performs a data compression per block of 8x8, the quantization table Q is constituted by the matrix of 8x8 corresponding to it.
[0028] The basis child-ized table Q is a quantization table for performing a data compression with standard condensation. Quantization processing does a division to the DCT multiplier F of 8x8 by the multiplier to which it corresponds in the quantization table Q. A DCT multiplier has a low spatial

frequency component, and its frequency component is as high as the direction of the upper left of a matrix as the direction of the lower right. The basis child-ized table Q is as fine as a frequency component low as a whole, and it is shown that a higher frequency component quantizes coarsely. Generally, a data compression is performed by deleting the information on the high frequency component of image data in consideration of a high frequency component having many noises in consideration of human being's vision property.
[0029] Return and a multiplier 12 multiply the basis child-ized table Q by the scale factor SF at drawing 1 . That is, all the elements of the matrix of the basis child-ized table Q are multiplied by the scale factor SF. A multiplier 12 outputs quantization table SF-Q.
[0030] A scale factor SF is equivalent to the condensation of code data. It is shown that condensation is so large that a scale factor SF is large, and it is shown that condensation is so small that a scale factor SF is small.
[0031] SF-Q is supplied to a divider 13. A divider 13 outputs the quantization multiplier Ruv which breaks the DCT multiplier Fuv memorized by the DCT coefficient memory 3 by quantization table SF-Quv, and shows it by the bottom formula. Rolling round means integer-ization to the nearest integer.
[0032]
Ruv=round [Fuv/(SF-Quv)]
The coding section 5 performs coding processing to the quantization data Ruv. Coding processing includes processing of run length coding and Huffman coding. Run length coding can perform high compression to data with which the value of 0 continues continuously. For the quantization data Ruv, many 0 is an assembly and a cone to the lower right part (high frequency component) of a matrix. High compression can be performed if run length coding is performed for the matrix Ruv of quantization data with a zigzag scan using this property. A zigzag scan is the approach of performing a sequential scan towards a high frequency component from a low-frequency component.
[0033] After the coding section 5 performs run length coding, it performs Huffman coding and generates code data. A counter 6 counts the amount valve flow coefficient of the code data generated in the coding section 5. The image of one frame consists of n blocks. Since code data is generated per block, a counter 6 computes the amount (henceforth code volume) valve flow coefficient of the code data of the image of one frame by accumulating the amount of the code data of all blocks (n blocks).
[0034] The code volume valve flow coefficient is supplied from a counter 6, and also the target code volume CVx is supplied to the scale-factor decision section 7 from the exterior. The target code volume CVx is the amount of the code data generated about the image of one sheet which a user or a system desires.
[0035] The scale-factor decision section 7 determines the scale factor SF which should be supplied to the quantization section 4 based on the code volume valve flow coefficient and the target code volume CVx which were counted. And after supplying some kinds of scale factors SF to the quantization section 4 and obtaining the code volume in each scale factor SF, the scale factor SFn corresponding to the target code volume CVx is presumed, and it outputs to the quantization section 4.
[0036] A scale factor SFn is presumed as condensation for generating the code data of the target code volume CVx. Statistics processing will be ended if a scale factor SFn can be found.
[0037] Drawing 3 is a flow chart which shows the procedure which the picture compression system by this example performs. A picture compression system performs fixed-length-ized processing and generates code data. The target code volume fixed-length-ized is CVx.
[0038] Statistics processing is performed at a step SA 1. Statistics processing presumes the scale factor SFn for generating the target code volume CVx. A scale factor SFn is outputted from the scale-factor decision section 7. The detail of statistics processing is explained referring to drawing 5 behind.
[0039] At a step SA 2, formal compression processing is performed using the scale factor SFn determined by statistics processing. A scale factor SFn is supplied to the quantization section 4. A picture compression system performs a data compression using a scale factor SFn, and generates the code data of the image of one sheet.
[0040] Code data is outputted from the coding section 5. The code volume of the code data generated

can be brought close to the target code volume CVx with high degree of accuracy. Above, fixed-length-ized compression processing is ended.
[0041] The scale-factor decision section 7 of drawing 1 memorizes the average characteristic curve av shown in drawing 4 (B). The average characteristic curve av is a curve of the code volume valve flow coefficient which makes a scale factor SF a function. How to search for the average characteristic curve av is explained below.
[0042] Drawing 4 (A) is a graph which shows four typical characteristic curves. An axis of abscissa shows a scale factor SF, and an axis of ordinate shows the code volume valve flow coefficient. Curves SP1, SP2, SP3, and SP4 show the characteristic curve of a respectively typical image. A characteristic curve changes with classes of image. Although, as for the code volume valve flow coefficient, a scale factor SF becomes small so that any images become large, the degree of the change changes with classes of image. For example, when a scale factor SF is enlarged, some which become small rapidly have the code volume valve flow coefficient, and some which hardly change have the code volume valve flow coefficient.
[0043] Drawing 4 (B) is a graph which shows the average characteristic curve av. An axis of abscissa shows a scale factor SF, and an axis of ordinate shows the code volume valve flow coefficient. The average characteristic curve av is generated based on the typical characteristic curves sp1-sp4 of drawing 4 (A), and is an average characteristic curve of all images. Although drawing 4 (A) shows only only four curves sp1-sp4 for the simplification of drawing, it is desirable to generate the average characteristic curve av based on the characteristic curve of as many images as possible. The average characteristic curve av is memorized by the scale-factor decision section 7 of drawing 1 .
[0044] The initial scale factor SFi is a scale factor corresponding to the target code volume CVx in the average characteristic curve av top. The target code volume CVx is a parameter supplied to the scale-factor decision section 7 from the exterior, as shown in drawing 1 .
[0045] The initial scale factor SFi is used in case statistics processing is performed. Next, statistics processing is explained. Drawing 5 is a flow chart which shows the detail of statistics processing of the step SA 1 of drawing 3 .
[0046] At a step SB 1, the data compression of the image of one sheet is performed using the initial scale factor SFi, and it asks for code volume CVx'. The situation is shown in drawing 6 (A). The initial scale factor SFi is a scale factor corresponding to the target code volume CVx in the average characteristic curve av top. The data compression of the object image is actually carried out using a scale factor SFi. It is obtained as a result of compression (for example, code volume CVx'). A point 21 is an intersection of a scale factor SFi and code volume CVx'.
[0047] If an object image has the same property as the average characteristic curve av, a point 21 is located on the average characteristic curve av. That is, code volume CVx' becomes the same value as the code volume CVx.
[0048] However, since characteristic curves differ according to the class of image, in almost all cases, code volume CVx' and the code volume CVx do not become equal. What is necessary is to determine the initial scale factor SFi as a scale factor SFn, and just to end statistics processing, when code volume CVx' becomes the same as the code volume CVx.
[0049] The following processings are continued when code volume CVx' and the code volume CVx are not equal. Here, the above processing is explained, referring to drawing 1 . The scale-factor decision section 7 supplies the initial scale factor SFi to the quantization table 4. A picture compression system carries out DCT processing of the image data memorized in the image memory 1 in the DCT section 2, and it quantizes in the quantization section 4 and it carries out coding processing in the coding section 5. A counter 6 outputs code volume CVx' of code data.
[0050] In addition, in case it asks for code volume behind, the directions approach of a scale factor SF and the calculation approach of the code volume valve flow coefficient are also the same as the above. It asks for new characteristic curve av' based on code volume CVx' for which drawing 5 was asked at the front step by return and the step SB 2.
[0051] The situation is shown in drawing 6 (B). A point 21 is an intersection of the initial scale factor

SFi and code volume CVx', and is a point which shows the property of an object image. It can presume that the characteristic curve of an object image becomes what passes a point 21. Then, it asks for new characteristic curve av' so that a point 21 may be passed. Characteristic curve av' is generated by carrying out the parallel displacement of the average characteristic curve av. The parallel displacement concerned may be migration of migration of the direction of an axis of ordinate, migration of the direction of an axis of abscissa, an axis of ordinate, and the direction of an axis of abscissa.
[0052] In addition, characteristic curve av' may be generated by the approach of not only when carrying out the parallel displacement of the average characteristic curve av, but others. Moreover, characteristic curve av' may not pass a point 21. However, it is desirable to generate based on the average characteristic curve av and a point 21.
[0053] At return and a step SB 3, n scale factors are determined based on characteristic curve av', and a data compression is performed to drawing 5 using the n scale factors concerned. n code volumes are obtained by performing n data compressions.
[0054] Then, in a step SB 4, an approximate characteristic curve is searched for based on n code volumes obtained at the front step. The situation is shown in drawing 7 (C) and (D). As shown in drawing 7 (C), the scale factor SFx corresponding to the target code volume CVx is searched for on characteristic curve av'. What the scale factor which should be searched for is probably near SFx is guessed.
[0055] Next, as shown in drawing 7 (D), n scale factors are determined in a field including a scale factor SFx. For example, it is referred to as n= 4 and four scale factors SF1, SF2, SF3, and SF4 are determined before and after SFx.
[0056] Although the value of n is arbitrary, if n is enlarged, highly precise statistics processing (fixed-length-ized processing) can be performed, and if n is made small, high-speed statistics processing can be performed. After determining scale factors SF1-SF4, a data compression is performed using each scale factor, and points 31, 32, 33, and 34 are searched for. A point 31 expresses the code volume when performing a data compression by the scale factor SF 1. Points 32, 33, and 34 express the code volume when carrying out a data compression by scale factors SF2, SF3, and SF4, respectively.
[0057] Next, the approximation characteristic curve apr is searched for based on points 31, 32, 33, and 34. The approximation characteristic curve apr can be searched for with for example, straight-line approximation, the least square method, etc. Moreover, the approximation characteristic curve apr may be generated by carrying out easy [of a certain curve], and moving the curve concerned to the coordinate location of points 31, 32, 33, and 34.
[0058] Highly precise statistics processing can be performed by asking for characteristic points 31, 32, 33, and 34 finely near [corresponding to the target code volume CVx] scale-factor SFx. Since it asks for a fine characteristic point only in the range after extracting [rather than] to the required range in quest of a characteristic point in all the range of a scale factor finely, statistics processing can be performed at a high speed.
[0059] Using the approximation characteristic curve apr for which drawing 5 was asked at the front step by return and the step SB 5, the scale factor SFn corresponding to the target code volume CVx is searched for, and statistics processing is ended.
[0060] The situation is shown in drawing 8 (E). The approximation characteristic curve apr is a curve approximated based on characteristic points 31, 32, 33, and 34. In this approximation characteristic curve apr top, the scale factor SFn corresponding to the target code volume CVx is searched for. A scale factor SFn is outputted to the quantization section 4 from the scale-factor decision section 7 (drawing 1).
[0061] Above, statistics processing is ended. By statistics processing, the scale factor SFn for realizing target code volume CVx is presumed. After statistics processing is completed, a data compression is performed using a scale factor SFn, and code data is generated.
[0062] Next, other examples of statistics processing are shown. By previous statistics processing, although the scale-factor decision section 7 (drawing 1) had memorized one average characteristic curve av, by this example, three characteristic curves MINCV, TYPCV, and MAXCV as the scale-factor

decision section 7 shows to drawing 9 are memorized.
[0063] Drawing 9 is a graph which shows three characteristic curves MINCV, TYPCV, and MAXCV. Three characteristic curves MINCV, TYPCV, and MAXCV are generated based on the typical characteristic curves sp1-sp4 shown in drawing 4 R> 4 (A).
[0064] Here, more ones but not only four of characteristic curves sp1-sp4 are good. If many characteristic curves are piled up, the band kept in a certain range will be made. A minimum is a curve sp1 and the upper limit of the band is a curve sp4.
[0065] In drawing 9 , Curve MINCV is a curve which shows near the minimum of a band. Curve MAXCV is a curve which shows near the upper limit of a band. Curve TYPCV is a curve which shows near the middle of a band.
[0066] The initial scale factor SFi is a scale factor corresponding to the target code volume CVx in Curve TYPCV top. Hereafter, statistics processing shown below is performed using this initial factor SFi.
[0067] Drawing 10 is a flow chart which shows the statistics processing which uses three characteristic curves. At a step SC 1, the data compression of the image of one sheet is performed using the above-mentioned initial scale factor SFi, and it asks for code volume CVx'.
[0068] The situation is shown in drawing 11 (A). The initial scale factor SFi is a scale factor corresponding to the target code volume CVx in a characteristic curve TYPCV top. If a data compression is actually performed by the scale factor SFi, code volume CVx' will be obtained, for example. A point 41 is an intersection of a scale factor SFi and code volume CVx'.
[0069] What is necessary is to determine the initial scale factor SFi as a scale factor SFn, and just to end statistics processing, when code volume CVx' becomes the same as the target code volume CVx.
[0070] The following processings are continued when code volume CVx' and the code volume CVx are not equal. One characteristic curve is chosen from three characteristic curves based on code volume CVx' for which drawing 10 was asked at the front step by return and the step SC 2.
[0071] The situation is shown in drawing 11 (B). First, called-for code volume CVx' investigates whether it is the closest to which characteristic curve of the three characteristic curves MINCV, TYPCV, and MAXCV. And the characteristic curve of No. 1 [about] is chosen. Hereafter, it explains concretely, referring to drawing.
[0072] Code volume CVx' is actually called for using the initial scale factor SFi. Then, each code volume of three characteristic curves at the time of using the initial scale factor SFi is compared with code volume CVx'.
[0073] In a characteristic curve MAXCV top, the code volume corresponding to the initial scale factor SFi is CVmax. In a characteristic curve MINCV top, the code volume corresponding to the initial scale factor SFi is CVmin. In a characteristic curve TYPCV top, the code volume corresponding to the initial scale factor SFi is CVx.
[0074] Code volume CVx' investigates whether it is the closest to which of the three code volumes CVmax, CVx, and CVmin. As an example, code volume CVx' explains the case of being the closest to the code volume CVmax.
[0075] When the closest to the code volume CVmax, code volume CVx' chooses a characteristic curve MAXCV, as shown in drawing 12 (C). Using the characteristic curve chosen as drawing 10 at the front step by return and the step SC 3, the scale factor SFn corresponding to the target code volume CVx is searched for, and statistics processing is ended.
[0076] The situation is shown in drawing 12 (D). The characteristic curve MAXCV should be chosen from three characteristic curves. In this characteristic curve MAXCV top, the scale factor SFn corresponding to the target code volume CVx is searched for.
[0077] This scale factor SFn is outputted to the quantization section 4 from the scale-factor decision section 7 (drawing 1), and ends statistics processing. After statistics processing is completed, a data compression is performed using a scale factor SFn, and code data is generated..
[0078] In addition, although the case where statistics processing was performed using three characteristic curves MINCV, TYPCV, and MAXCV was described, as long as it is two or more

characteristic curves, how many characteristic curves may be used. The precision for fixed-length-izing improves, so that many characteristic curves are used.
[0079] Although this statistics processing does not have a high precision for fixed-length-izing, improvement in the speed is realizable. When the width of face between the maximum characteristic curve MAXCV and the characteristic curve MINCV of a minimum is too wide, the precision for fixed-length-izing becomes low considerably, but it is practical when the class of object image is limited.
[0080] Drawing 13 shows an example which limits the class of object image. A user directs either of the three modes MD1, MD2, and MD3 to a picture compression system by operating a switch etc. according to the class of image. For example, a landscape image and the mode MD 2 of the mode MD 1 are the modes for a portrait image and the mode MD 3 to direct a complicated image.
[0081] The characteristic curve of the scale-factor SF pair code volume valve flow coefficient can do the band of the range corresponding to each mode according to the modes MD1, MD2, and MD3. By specifying the mode, the range of a characteristic curve is limited to the narrow range. If either of two statistics processings (drawing 5 and drawing 10 R> 0) shown above is performed after limiting the range of a characteristic curve to a certain amount of range, the highly precise scale factor SFn can be determined.
[0082] Namely, what is necessary is to determine the average characteristic curve av in statistics processing of drawing 5 , and just to determine three characteristic curves MINCV, TYPCV, and MAXCV in statistics processing of drawing 10 , after specifying the mode.
[0083] According to this example, the optimal scale factor for a high speed with a sufficient or precision can be searched for by statistics processing. Since precision and a rate have an opposite relation, any are thought as important changes with applications. A user can choose as arbitration whether precision is thought as important or a rate is thought as important according to an application, and can direct generation of the code data of the target code volume CVx.
[0084] In addition, the scale-factor decision section 7 (drawing 1) may memorize a characteristic curve as a function expression, and may memorize it as a look-up table. Moreover, statistics processing explained the case where all blocks included in the image of one sheet were processed. However, since statistics processing is for estimating code volume to the last, it not necessarily needs to process no blocks. Then, not all blocks may be processed, but only a sample block may be processed, and compaction of the processing time may be aimed at.
[0085] Furthermore, although how to search for a scale factor was explained, you may make it ask not for a scale factor but for the quantization table itself, and may make it ask for other parameters in statistics processing. In other words, parameters other than a scale factor may be adopted as condensation.
[0086] If the statistics processing for performing fixed-length-ization is needed, it is not limited to JPEG compression but can apply also to other compression. Although this invention was explained in accordance with the example above, this invention is not restricted to these. For example, probably, it will be obvious to this contractor for various modification, amelioration, combination, etc. to be possible.
[0087]
[Effect of the Invention] As explained above, according to this invention, in the 1st characteristic ray which shows condensation and the relation of code volume, object image data is encoded with the condensation corresponding to target code volume, and a correction characteristic ray is generated after that. Since it asks for correction condensation using the correction characteristic ray concerned, code data is generable with highly precise fixed-length-ized processing.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the picture compression structure of a system by the example of this invention.
[Drawing 2] It is drawing showing the matrix which constitutes a basis child-ized table.
[Drawing 3] It is the flow chart which shows the procedure which the picture compression system by this example performs.
[Drawing 4] Drawing 4 (A) is a graph which shows the characteristic curve of a typical image, and drawing 4 (B) is a graph which shows the average characteristic curve memorized by the scale-factor decision section.
[Drawing 5] It is the flow chart which shows the detail of statistics processing of the step SA 1 of drawing 3 .
[Drawing 6] Drawing 6 (A) is a graph which shows the relation between a scale factor SFi and code volume CVx', and drawing 6 (B) is a graph which shows characteristic curve av'.
[Drawing 7] Drawing 7 (C) is a graph which shows the relation between the target code volume CVx and a scale factor SFx, and drawing 7 (D) is a graph which shows an approximate characteristic curve.
[Drawing 8] Drawing 8 (E) is a graph which shows the relation between the target code volume CVx and a scale factor SFn.
[Drawing 9] It is the graph which shows three typical characteristic curves.
[Drawing 10] It is the flow chart which shows other examples of statistics processing.
[Drawing 11] Drawing 11 (A) is a graph which shows the relation between a scale factor SFi and code volume CVx', and drawing 1111 (B) is a graph which shows the code volume in a scale factor SFi.
[Drawing 12] Drawing 12 (C) is a graph which shows the relation between code volume CVx' and the code volume CVmax, and drawing 12 (D) is a graph which shows the relation between the target code volume CVx and a scale factor SFn.
[Drawing 13] It is the graph which shows the characteristic curve corresponding to the three modes.
[Description of Notations]
1 Image Memory
2 Discrete Cosine Transform (DCT) Section
3 DCT Coefficient Memory
4 Quantization Section
5 Coding Section
6 Counter
7 Scale-Factor Decision Section
8 Controller
11 Basis Child-ized Table Memory
12 Multiplier
13 Divider

[Translation done.]

* NOTICES *

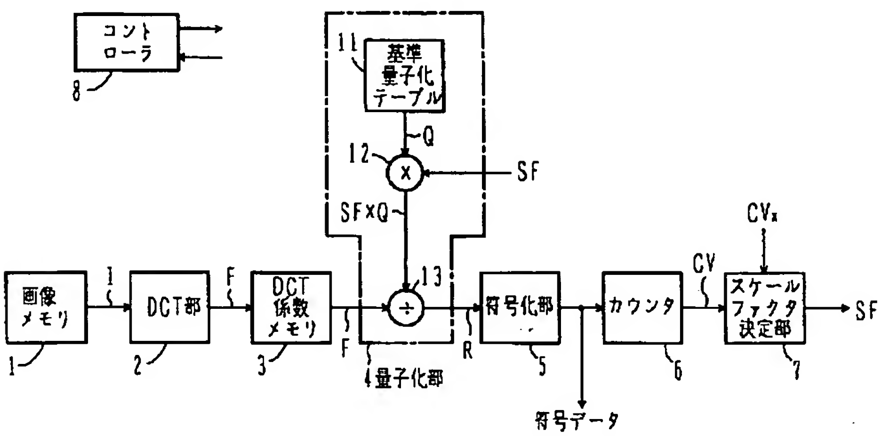
JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

全体構成

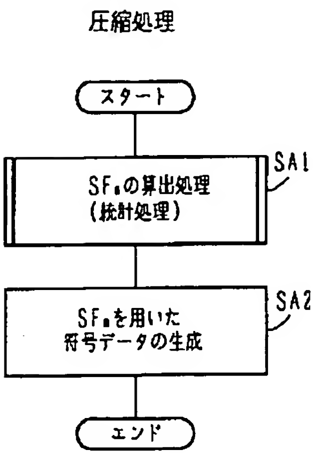


[Drawing 2]

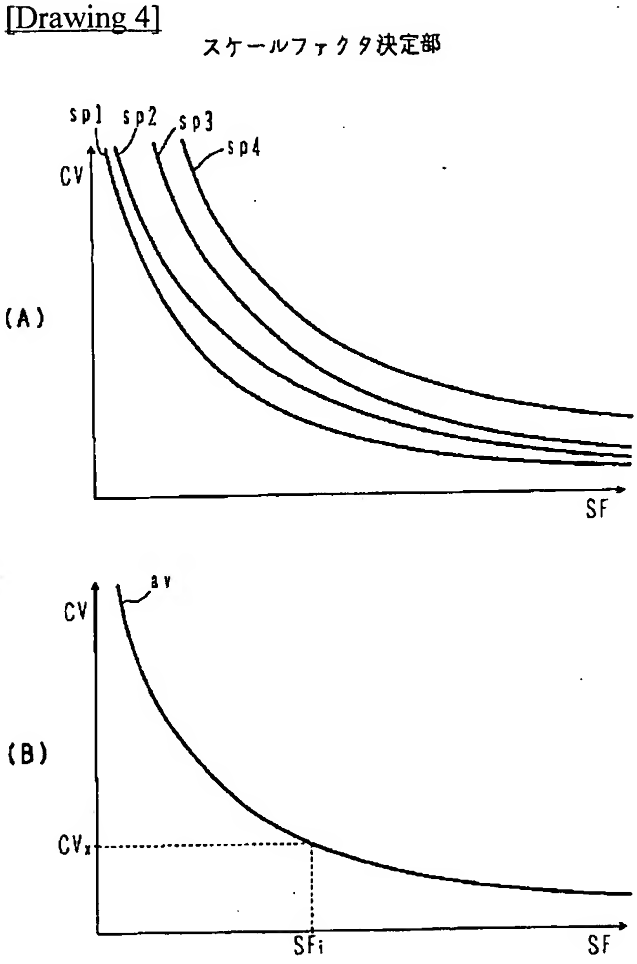
基準量子化テーブル

$$
\begin{pmatrix}
16 & 11 & 10 & 16 & 24 & 40 & 51 & 61 \\
12 & 12 & 14 & 19 & 26 & 58 & 60 & 55 \\
14 & 13 & 16 & 24 & 40 & 57 & 69 & 56 \\
14 & 17 & 22 & 29 & 51 & 87 & 80 & 62 \\
18 & 22 & 37 & 56 & 68 & 109 & 103 & 77 \\
24 & 35 & 55 & 64 & 81 & 104 & 113 & 92 \\
49 & 64 & 78 & 87 & 103 & 121 & 120 & 101 \\
72 & 92 & 95 & 98 & 112 & 100 & 103 & 99
\end{pmatrix}
$$

[Drawing 3]

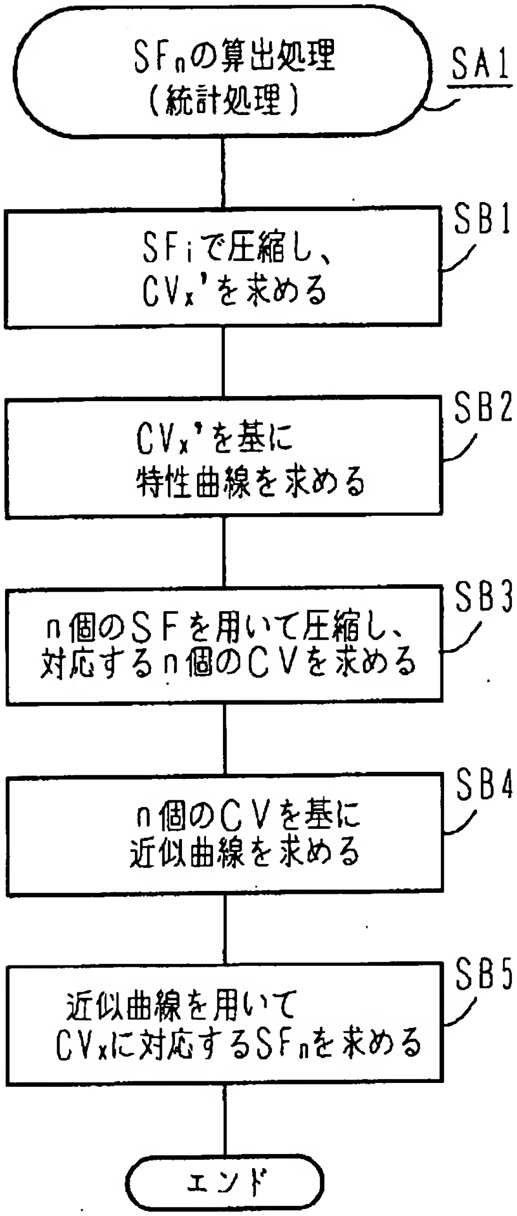


[Drawing 4]



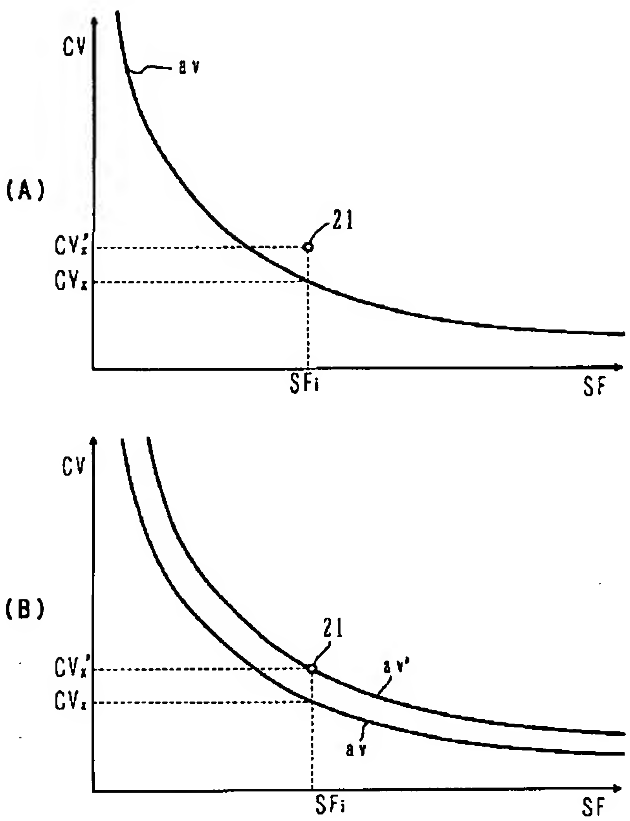
[Drawing 5]

統計処理 I



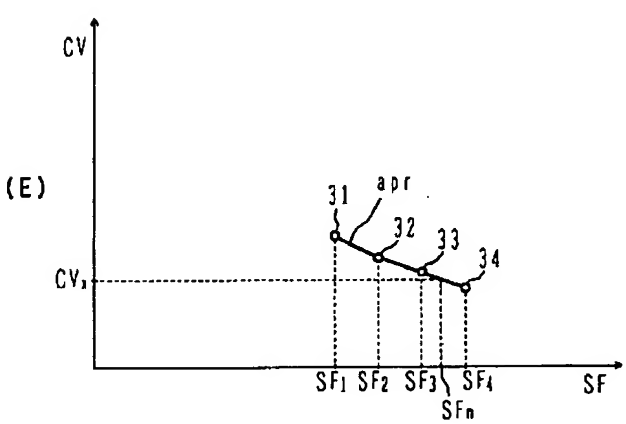
[Drawing 6]

統計処理I

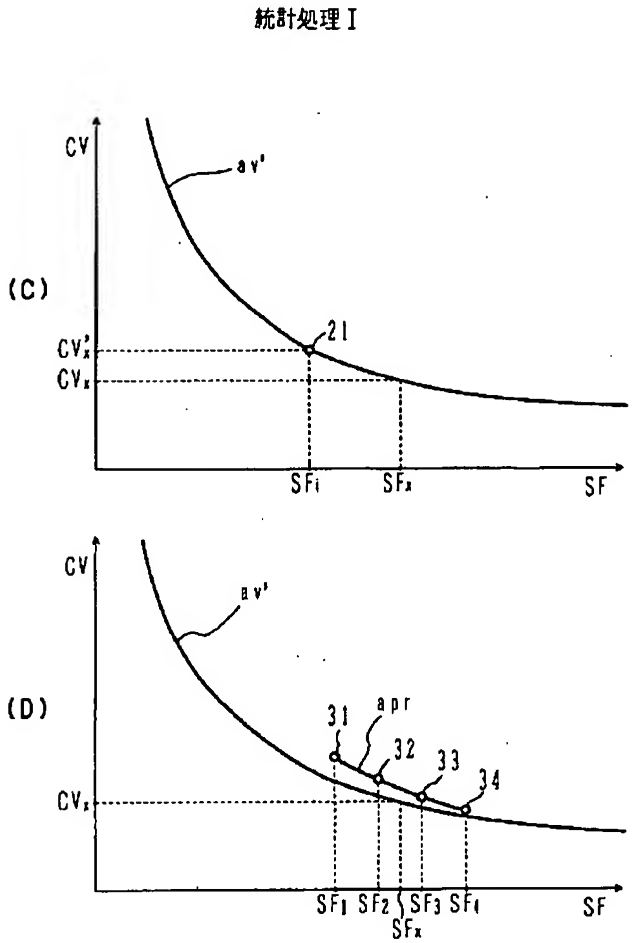


[Drawing 8]

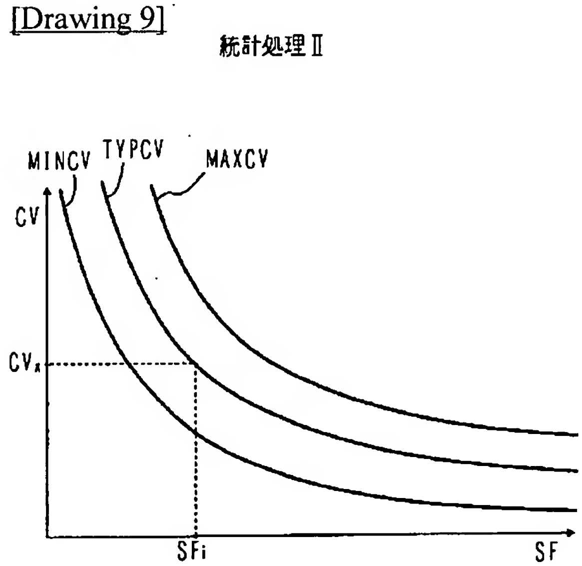
統計処理I



[Drawing 7]

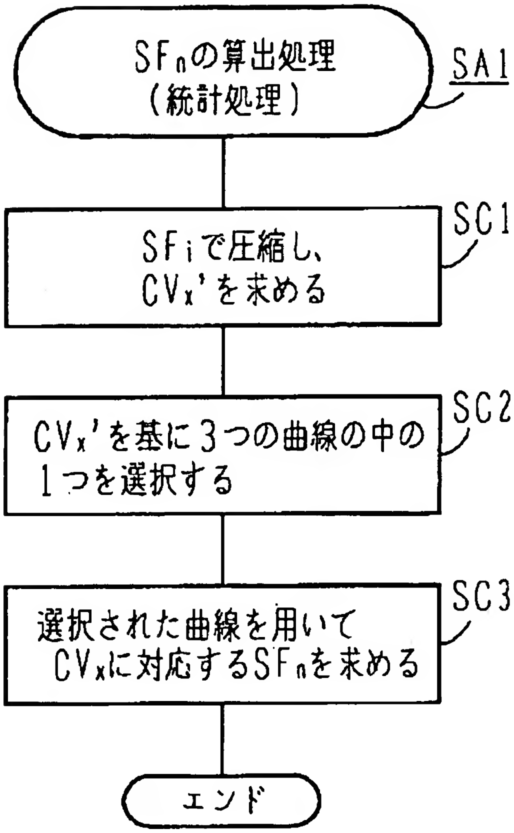


[Drawing 9]



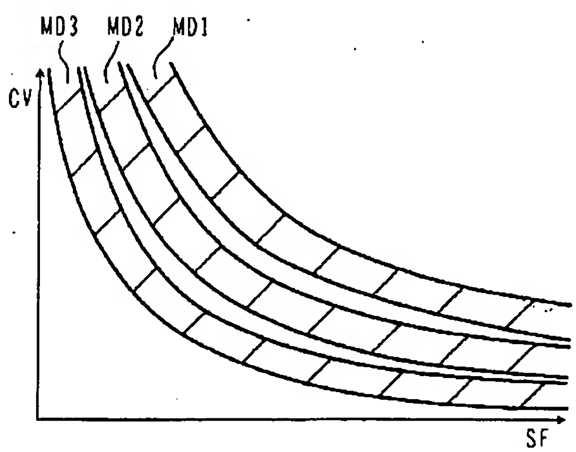
[Drawing 10]

統計処理Ⅱ

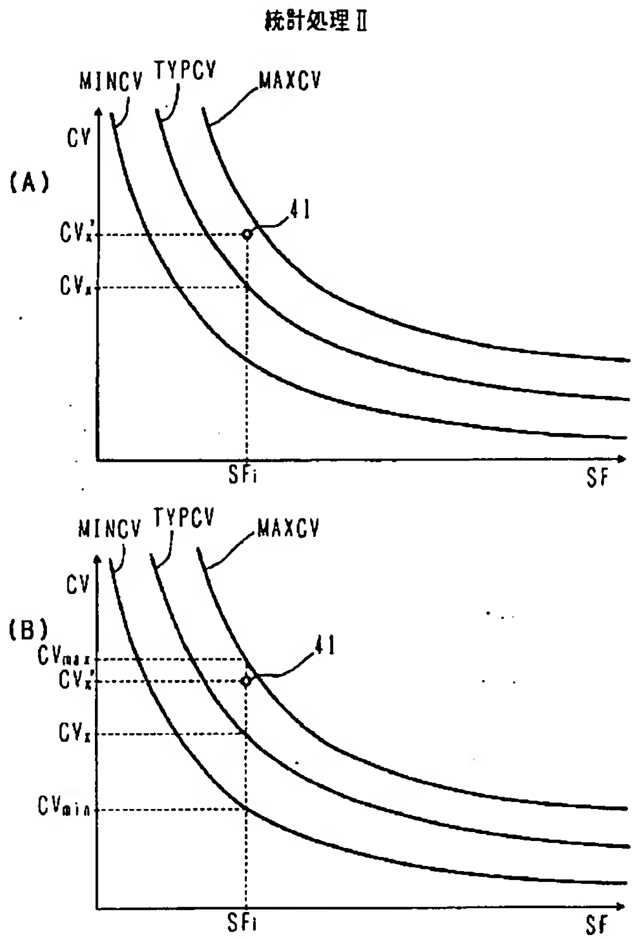


[Drawing 13]

モード分類



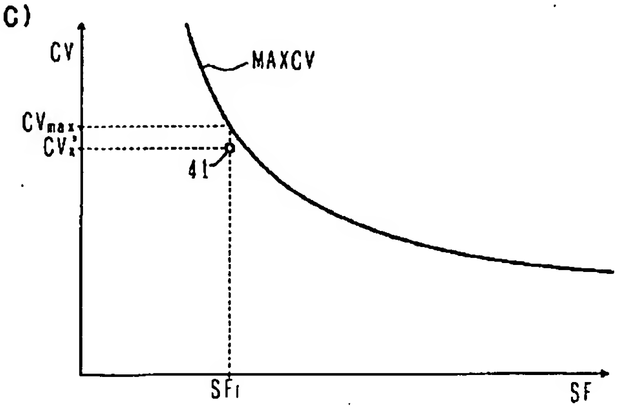
[Drawing 11]


統計処理 II
MINCV
TYPCV
MAXCV
CV
(A)
41
CVx'
CVx
SFi
SF
MINCV
TYPCV
MAXCV
CV
(B)
41
CVmax
CVx'
CVx
CVmin
SFi
SF

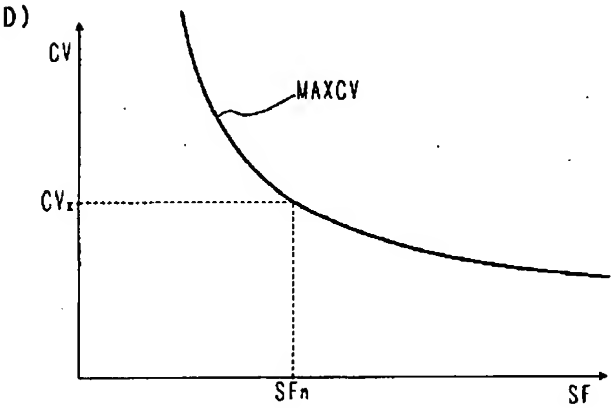
[Drawing 12]

統計処理 II

(C)



(D)



[Translation done.]